Ted Shapiro, Geology 120 Lab, Igneous Report, due Tue, 9-19

Section 1: The Full Definition of An Igneous Rock:

A rock is a coherent, naturally occurring solid that consists of an aggregate of minerals or, less commonly, a body of glass. Igneous rock is rock that forms when magma or lava cool to a solid state.

A mineral is a naturally occurring solid, formed by geologic processes, that has a crystalline structure, is usually inorganic, and has a definable chemical composition.

Rocks are often, but not always, made up of minerals. Minerals are made up of elements, and so are rocks. Minerals are solid, and so are rocks. Minerals are naturally occurring, and so are rocks. A mineral has a crystalline structure, but a rock may or may not have a crystalline structure. I believe that rocks are also granted more leeway than minerals, when it comes to being organic (carbon based, or formed by, or of, living organisms).

Section 2: The Major Terms Used With Igneous Rock.

Aphanitic means that the crystals are so small that they are not visible to the unaided human eye.

Volcanic means *extrusive*, as opposed to *intrusive*. So volcanic rock tends to have cooled rapidly on the surface, and have small crystals, or sometimes, none at all. Volcanic rock has also been released from a high pressure environment into a low pressure environment so it may have gas holes.

Phaneritic means that the crystals are visible to the unaided human eye, 1-10 mm across.

Plutonic means intrusive, that is to say, formed under pressure, deep within the Earth, where Pluto, the god of the underworld reigns.

Pegmatitic means having very large crystals greater than a centimeter across.

Porphyritic means having crystals of two distinct sizes.

Felsic in modern usage, refers to relatively light magmas, lavas, and igneous rocks that contain more than 60% silica.

Intermediate, refers to magmas, lavas, and igneous rocks that are between felsic and mafic, more specifically, to those that contain 54 to 64 percent silica.

Mafic refers to dense, often dark, magmas, lavas, and igneous rocks that are high in magnesium and iron, and contain 45-53 percent silica.

Ultra Mafic Is like mafic, but more so, but specifically, in modern usage, it refers to magmas, lavas, and igneous rocks that contain less than 45 percent silica.

Section 3: The Process Used To Identify Igneous Rocks.

Step 1: Estimate the rock's color index (MCI). If the crystals are large enough to see with the naked eye, the percentage of dark, (dark grey, black or green) mafic crystals is estimated. If it is 46 to 85 percent, the rock is classified as mafic. If the percentage of dark, mafic, crystals is over 85 percent, the rock is classified as ultramafic. If the percentage of mafic crystals is less than 15 percent, the rock is classified as felsic. If the percentage of mafic crystals is 16 to 45 percent, the rock is classified as intermediate. If the crystals are not visible to the naked eye, (aphanitic), the overall color of the rock is used to determine whether the rock is felsic or mafic. If it is dark grey, black, or green, it is probably mafic. If it is white, pink, or light grey, it is probably felsic.

Step 2: Identify the main rock forming minerals if the crystals are large enough to do so, and estimate the relative abundance of each mineral. Felsic characteristics such as light color and light weight indicate the presence of minerals high in silica and aluminum such as quartz, kspar, and plag. Quartz is very hard, translucent, often grey, and lacks cleavage. K-spar is hard, opaque, and usually orange, pink, or white. It has exsolution lamellae (slightly wavy hair like lines). Plag is hard, opaque, usually white or pale grey, cleaves at nearly 90 degrees, and has twinning lines (straight parallel lines). Mafic characteristics, such as being dark and heavy, indicate the presence of minerals high in iron and magnesium, such as amphibole (Hornblende), pyroxene, (augite) and olivine. Amphibole is dark grey to black, hard but brittle, cleaves at 56 and 124 degree, and tends to be splintery or stringy. Pyroxene (augite) is hard, dark green to greenish grey, and the two cleavages intersect at nearly 90 degrees. Olivine is hard, transparent to opaque, pale yellow green to dark green, and lacks cleavage. The crystals resemble sand grains. Biotite and muscovite micas are both soft, and can both be split into thin flexible sheets, but biotite tends to be black or greenish black, while muscovite tends to be colorless, yellow, brown, or reddish brown. Muscovite is also a little softer than biotite.

Step 3: Identify the texture(s) of the rock. If the crystals are larger than 1 centimeter across, the rock is pegmatitic. This indicates very slow cooling of the magma, deep within the Earth, that is to say, a plutonic (plutonic) process. If the crystals are about 1-10 millimeters across, the rock is said to be phaneritic. This indicates that the magma cooled slowly at a great depth within the Earth. The rock is of intrusive (plutonic) origin. If there are large and small crystals mixed together in the same rock, the rock is said to me porphyritic. This indicates rapid, then slow, cooling, and or change in the magma viscosity or composition. If the crystals are too small to be seen with the naked eye, the rock is called aphanitic. This indicates that the lava cooled rapidly at the surface. The rock is extrusive (volcanic). If the rock is glassy, the lava cooled very rapidly and or there was very poor nucleation. The rock is extrusive. If the rock is light weight with air bubbles or gas holes, the rock is called vesicular. This indicates rapid cooling of gas charged lava: the rock is volcanic. If the rock is broken in pieces, whether large or small, it is called pyroclastic. It was emitted from a volcano, and is therefore extrusive.

Step 4: Use the Igneous Rock Classification Flowchart to name the rock.

Section 4 My Observations of the Major Igneous Rocks We Saw In Lab.

Granite:

Granite appears speckled. it is somewhat variable in color, but it often looks pinkish, on a light grey background with black specks. The crystals are visible (Phaneritic or pegmatitic). It is hard, and contains

an abundance of felsic minerals; K-spar, plag, and quartz. It is of intrusive (plutonic) origin. I imagine that the pink, white, and grey, are quartz and feldspars, while the black specks must be amphibole or biotite.

Rhyolite: Rhyolite is a fine grained aphanitic rock, that is usually pink, white, or pale brown. It is a relatively light weight felsic rock that appears to be high in K-spar, and is volcanic origin.

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Diorite: Diorite is phaneritic or pegmatitic rock with clearly visible black and white crystals. It seems to be fairly hard, but not too heavy. It is a felsic rock that seems to be high in plag, with some kspar and quartz. It also appears to contain amphibole, and maybe some biotite. It is of intrusive origin.

Andesite: is a fine grained aphanitic rock, somewhat similar to rhyolite in appearance. It is usually grey or greenish grey. It seems to be of medium weight, and fairly hard. It is considered to be intermediate, with an MCI of 15 – 45. It is volcanic.

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Gabbro: Is a dark grey or black rock with phaneritic or pegmatitic crystals. It seems to be dense, and fairly hard. It is a mafic rock of plutonic (intrusive) origin. I

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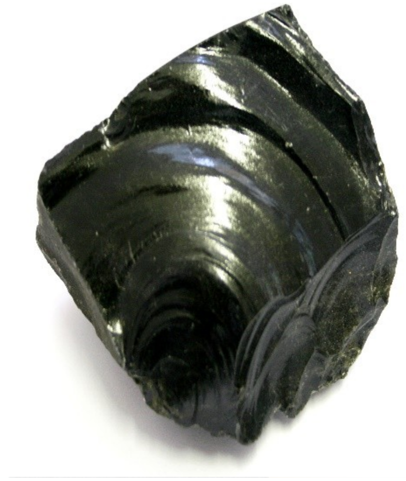
believe that it is high in Pyroxene (augite) and also has quite a bit of plag (plagioclase feldspar) along with perhaps a little olivine and amphibole (hornblende).

Basalt: Is a dark heavy mafic rock, similar in color to gabbro, however, it is very fine grained, (aphanitic) and is of volcanic origin. ***Vesicular Basalt*** (not shown) is basalt that has air bubbles or gas holes in it, and is chemically similar, but is lighter and looks a bit like pumice.

Obsidian: Obsidian is a glassy, dark volcanic rock that lacks crystals. When struck, it shatters conchoidally, forming very sharp edges. It was widely used by Native Americans for tools and weapons. It appears to contain a lot of silicon, (feldspars and quartz) but also some amphibole (hornblende).



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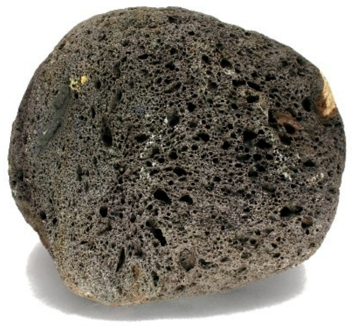
Pumice: Is very light weight due to the abundant vesicles (air bubbles and gas holes) that it contains. It is often grey, and is volcanic. It is considered to be felsic or intermediate.



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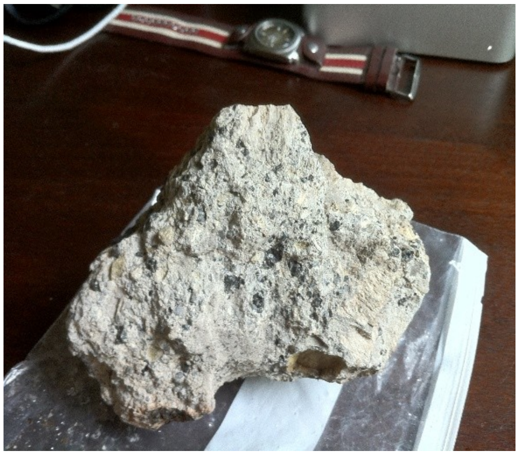
Scoria: Looks somewhat similar to pumice, but it tends to more reddish, and the vesicles are often larger. It is mafic, so the material is denser than pumice. It is volcanic.

Tuff: Tuff is a pyroclastic rock, (fire broken) that gets broken in pieces when it is blasted out of a volcano. It is often an off white or grey color. The hardness seems to quite variable, from quite soft, to fairly hard. It is of course, extrusive. *Volcanic Breccia* is similar, but consist of larger fragments.



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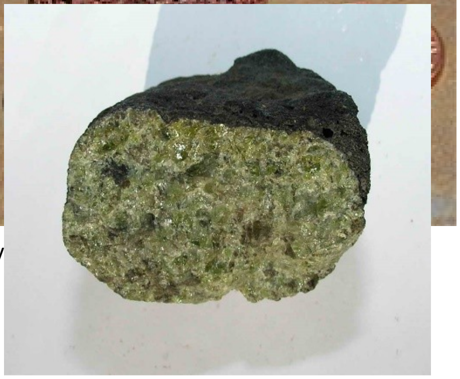
Dunite : Dunite is a type of *Peridotite* that contains more than 90% olivine. It is often green or grey. The crystals are phaneritic or pegmatitic. It is quite dense and heavy. It is ultramafic, so it must contain a lot of Iron and magnesium



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